THE 1991 PRESIDENTIAL ADDRESS—PART 2 SOME HORTICULTURAL PESTS NEW TO BRITAIN IN RECENT YEARS

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Glasshouse whitefly, woolly aphid, large narcissus bulb fly, carnation tortrix moth, red lily beetle and Solomon's seal sawfly. These are all examples of insects that have been inadvertently introduced into Britain over the years and have become established as pests. Britain's island status has prevented many pests commonly found on the mainland of Europe and elsewhere from reaching these shores but whenever goods are imported, especially growing plants, or fruits and vegetables, there is a danger that unwelcome insects will come with them. Britain has a long history as a nation of gardeners and certainly since Roman times exotic plants have been brought here to enhance our gardens. During the latter half of the 18th century, and in subsequent years, there was an upsurge in the desire by the landed gentry to have new ornamental plants growing in their gardens and conservatories. Expeditions were sent out to the New World, Australasia and remote places in the Far East with the primary aim of finding exciting new plants. This greatly increased the potential for introducing alien insects, although the distances involved and the slow means of transport available meant that most plants were collected as seeds or dry bulbs. Such material is much less likely to carry pests than growing plants and soil.

The situation today is rather different. There is now a world-wide trade in fruits, vegetables, growing plants and cut flowers. Produce being grown in places such as Colombia or Thailand can be on sale in Britain within 48 hours of dispatch. The volume of imported material and the speed with which it arrives and is distributed makes the exclusion of alien pests much more difficult. This task is the responsibility of the Ministry of Agriculture, Fisheries and Food, through the Plant Health and Seeds Inspectorate (PHSI), who are probably best known to the man in the street for the posters of Colorado beetle that adorn police station notice boards. The Colorado beetle, *Leptinotarsa decemlineata* (Say), is one of the great success stories for the PHSI, since although this north American potato pest has spread throughout the mainland of Europe it has been prevented from getting established in the British Isles. Every year some adult beetles are intercepted at the docks or in greengrocer's shops, and just occasionally outbreaks occur on growing crops. Prompt action has eradicated these outbreaks and kept us free of this pest. As a would-be invader, Colorado beetle has a couple of serious handicaps—it is big enough to be seen and has a very distinctive appearance. My talk this evening is going to cover some of the pests which have become successfully established in Britain over the last 15 years or so. Most of these are small, fairly nondescript insects, although their impact on their host plants can be severe once they have built up into damaging infestations.

Successful establishment implies that the pest is able to find suitable host plants, to breed and maintain itself in successive seasons. Some, however, may only survive for a few years or a successful establishment may be limited by the pest's inability to spread beyond the initial point of arrival. The first two insects I am going to talk about are examples of pests which have had only partial success since arriving in Britain. Both are sap-feeding insects associated with conifers.

Fiorinia externa Ferris (Hemiptera: Diaspididae) is a scale insect which, as far as I know, is confined to a single plant of the Korean fir, *Abies koreana*, growing in the Royal Horticultural Society's Garden at Wisley, Surrey (Williams, 1988). Its

presence was not discovered by myself but by a student gardener who presented it as part of his pest collection in 1987. The tree, which was growing in a pot in the alpine house, had come to Wisley from a nursery in New Jersey, USA, in 1980. The mature scales are brown or yellowish-white in colour and have a flattened elongate shape up to 2 mm long. Heavy infestations are made more visible by the secretion of a white powdery wax produced by the scales. They feed on the undersides of the leaves and can cause a yellow mottling of the upper leaf surface and premature leaf fall. This species was first described in America in the 1940s, although it had been known there under another name since at least 1908. It almost certainly originates from the Japan/Korea region. In the US it has been recorded from a very wide range of conifers, including *Abies* spp., *Cedrus* spp., *Picea* spp., *Pinus* spp., *Taxus* spp., *Tsuga* spp. and *Pseudotsuga menziesii* in an arboretum in Connecticut (McClure & Fergione, 1977). *Tsuga* spp. or hemlocks seem to be particularly susceptible. Research in America has shown that this scale has at least two generations a year but due to an extended egg laying period there is considerable overlapping of the generations and all stages in the life cycle can be found together at most times of the year (Garrett & Langford, 1969; Stimmel, 1980). This makes control more difficult and that is my excuse for the fact that, despite spraying, this scale insect is still present on the same small tree at Wisley in 1992.

In September 1982 I was sent some shoots of Monterey cypress, *Cupressus macrocarpa*, by a tree surgeon who had been working in a private garden near Kingston-upon-Thames, Surrey. The upper surfaces of the shoots were blackened with sooty mould, which is a non-parasitic fungus that develops on the sugary excretions (honeydew) produced by various sap-feeding insects. On this tree the culprits were a type of mealybug, *Planococcus vovae* (Nassanov) (Hemiptera: Pseudococcidae) which originates from the mainland of Europe, where it also attacks *Juniperus* and *Thuya* spp. (Williams, 1984). A visit to Kingston revealed that there were 12 *Cupressus* trees planted by the roadside edge of the front garden and these were showing varying degrees of infestation. Some shoots on three of the trees had dense aggregations of the 2 to 3-mm-long pinkish-white mealybugs, which were clustered on the undersides of the shoots. The owner was unable to say when the trees were planted as they were already in place when he bought the property 3 years previously. Some trees were about 7.5 m (25 ft) tall and were probably at least 10–15 years old. Since 1982 only one other example of this pest has been sent to Wisley. This came from a garden close to the original site in the following year. No effective control measures have been taken against this pest due to the size of the trees and their proximity to the road and pavement. Annual visits to the original site have shown that the mealybug has persisted up until 1991 when no signs of active infestation could be detected on branches accessible from ground level. It may have died out or it may have dropped to a low level at which it might tick over for a number of years until suitable conditions permit it to increase again. The high level of infestation seen in 1982 was not repeated in any of the subsequent years.

Another mealybug which has been more successful in Britain is the phormium mealybug, *Balanococcus* (*Trionymus*) *diminutus* (Leonardi) (Hemiptera: Pseudococcidae). This comes from New Zealand and it attacks New Zealand flax, *Phormium tenax* and *Cordyline* spp. It was first detected by a member of the PHSI on imported *Phormium* plants on a nursery in Norfolk in 1977, with another find at a nursery in Cornwall the following year (Bartlett, 1981). Introduced mealybugs are usually regarded as glasshouse pests in Britain but *B. diminutus* is capable of surviving very low temperatures. The mealybugs at St Erme, Cornwall, survived a 2-week period in the winter of 1978/79 when the bases of the plants were under snow. There was

a 3-day period in January 1979 when the maximum daily temperature did not exceed 0 °C and 2 days when the minimum air temperature was − 8.2 °C, with minimum temperatures at ground level of − 16.9 and − 17.2 °C. Attempts were made to prevent the mealybug from becoming established by destroying infested nursery stock and requiring New Zealand suppliers to dip their plants in insecticide before sending them for export.

B. diminutus is a greyish-white insect up to 5 mm long and it mainly infests the base of the plant between the ensheathing leaves. This habit, together with the waxy secretions that mealybugs produce from their bodies, makes it difficult to contact the pest with insecticides. Infested plants continue to be imported into Britain and it is not difficult to find this insect on phormiums in garden centres. The phormium mealybug can develop infestations that are sufficiently heavy to cause the host plant to deteriorate and die. Its survival in Britain is probably dependent on fresh importations, since mealybugs do not have winged females and therefore cannot fly away from a dying plant to find another. In Britain phormiums are likely to be widely scattered, except in nurseries, and this would also limit the pest's ability to spread.

A pest that has had no difficulty in dispersing is the lupin aphid, *Macrosiphum albifrons* Essig (Hemiptera: Aphididae). This is widespread in the United States and Canada, where it attacks various types of lupin, *Lupinus* spp. It was first recorded in Britain at the Royal Botanic Gardens, Kew, Surrey, in September 1981 on many of the lupins in the systematic plant beds (Stroyan, 1981). By the following year it was turning up throughout southern England and by 1984 had reached Scotland. It has since crossed the Channel and can be found in Germany, Holland, Czechoslovakia and probably elsewhere. It is an exceptionally large aphid, being 4–5 mm long, and is greyish-white in colour. Many aphids overwinter as eggs on a woody plant on which they feed in the spring before migrating to a herbaceous plant for the summer period. The lupin aphid, however, spends the whole year on lupins and overwinters in small numbers on the plant's basal buds. When the plants come into growth in the spring the aphids start to increase, with peak populations usually occurring in early summer as lupins are coming into flower. Dense colonies of the aphids occur on the flower spikes and on the undersides of the leaves, which become sticky with honeydew. Sap sucking by the aphids can be so severe that lupins will wilt and die. The indigenous insects that normally eat or parasitize aphids seem to have little interest in *M. albifrons* although in West Germany predation has been observed by the ladybird *Coccinella 7-punctata* L. and the lacewing *Chrysoperla carnea* (Steph.). A fungus *Erynia neoaphidis* can cause high mortality during periods of damp weather (Gruppe & Roemer, 1988).

Another much travelled pest is the hydrangea scale, *Pulvinaria hydrangeae* (Steinweden) (Hemiptera: Coccidae). This species was first described in California but it probably originates from Japan, which is also the source of hydrangeas. It arrived in the south of France sometime before 1965, where it is said to attack hydrangea, maple, lime and other trees (Canard, 1965). By 1974 it was reported at Padua in Italy on hydrangea, lime (*Tilia platyphyllus*), maples (*Acer negundo* and *A. platanoides*), persimmon, *Crataegus* and *Deutzia* (Scaltriti, 1976). Some additional host plants given in the literature are *Actinidia* in New Zealand (Archibald *et al.*, 1979) and *Prunus*, *Cornus* and *Viburnum* in Belgium (Merlin *et al.*, 1988). This scale insect is also found in Germany and Holland. The first specimens received at Wisley Garden came from a heavily infested hydrangea growing in a private garden at Wimbledon, London SW19, in 1988. Other specimens have subsequently been received from the Wimbledon district and the following places in the London area: Charlton SE7, the SE24 district, and from Stanmore and Edgware in Middlesex. All of these

infestations were on hydrangea with no indication of other plants being affected. Some of the infestations were of several years' standing, indicating that this pest arrived in Britain during or before 1987. It is tempting to suspect that a garden centre situated somewhere on the west side of London received a batch of infested plants from perhaps Belgium or Holland at that time. Scale insects are not very mobile pests, although the recently hatched crawler nymphs may get blown about by the wind. For much of their life cycle scale insects remain immobile on their host plants, and so the movement of plants through the horticultural trade is of great importance for their dissemination.

Hydrangea scale is most easily recognized during the early summer when the females mature and lay eggs. The mature scales are wrinkled oval brown objects up to 4 mm long. The eggs are deposited amongst a mass of white waxy fibres that are secreted from the insect's body (Plate I, Figure 1). Eggs hatch in midsummer and the young nymphs feed mainly on the undersides of the leaves next to the leaf veins from which they suck sap. Old egg masses persist on the stems and leaves for a long time after hatching has taken place. By the autumn the nymphs have reached the third nymphal stage and have moved onto the stems, where they overwinter. This species of scale insect is parthenogenetic and appears to have one generation a year in Britain. Heavy infestations are likely to cause host plants to suffer a loss of vigour. Control with chemicals is complicated by the fact that hydrangeas are sensitive to spray damage by many of the pesticides approved for scale insect control.

So far all of the pests I have described have been sap-feeding members of the Hemiptera. The next two pests are flies of the family Cecidomyiidae. The honey locust tree, *Gleditsia triacanthos* is a north American plant that has been grown in Britain for many years and was regarded as being pest free. Its popularity as a garden plant has increased considerably since the introduction of the variety 'Sunburst'. This has young foliage that is an attractive golden yellow colour which is continually produced at the shoot tips throughout the summer. Unfortunately a north American gall midge, *Dasineura gleditchiae* (Osten-Sacken) has found its way to Europe, arriving first at Boskoop in Holland in 1977 (Nijveldt, 1980). It came to Britain in the early 1980s and was first recorded in the RHS Garden at Wisley, Surrey, in July 1983. The females lay kidney-shaped eggs amongst the developing leaves at the shoot tips. The orange-coloured larvae are up to 2 mm long and their feeding prevents the foliage from expanding to its usual pinnate form. Instead the leaflets become thickened and folded in half to form pod-like galls which can contain up to seven larvae. At Wisley adults have been observed emerging and laying eggs in early June, early July and August. However, in 1991, when June was unusually cold, there was virtually no activity until July. Pupation takes place inside the galls during the summer but the final generation overwinters in the soil. The effect on the tree is a progressive crippling of the new foliage as successive generations develop, often causing new growth to cease by the end of July.

At Wisley Garden there is a tree of *Gleditsia triacanthos* 'Elegantissima' growing less than 100 m from a 'Sunburst'. While the latter is heavily infested, 'Elegantissima' shows no sign of galling. These trees have a different growth habit, with 'Elegantissima' having a denser branch structure and darker green foliage, but they have always been assumed to be selected forms of *G. triacanthos*. It is possible that the apparent resistance of 'Elegantissima' may be an indication that it is in fact a hybrid between *triacanthos* and some other *Gleditsia* species. Gleditsia gall midge is now widely established in south east England, with records being received at Wisley from Surrey, Kent, Hants, Sussex, Berks., Essex and central London.

The other new gall midge is *Contarinia quinquenotata* (Löw, F.) which attacks the flower buds of day lily, *Hemerocallis fulva*. Like the honey locust, this was,

until the arrival of the gall midge, regarded as a pest-free plant in British gardens. The midge is of widespread occurrence in central Europe and was first found in Britain at Weybridge and the RHS Garden at Wisley, both in Surrey, in June 1989 (Halstead & Harris, 1990). Since then other records have been received from Buxted, Herstmonceux and Ditchling, all in Sussex, and from Bounstone, near Farnham, Surrey. Adult midges emerge from overwintering pupae in the soil and begin laying eggs in the flower buds in May–June. Large numbers of white larvae, up to 2 mm long, can develop inside each bud which becomes enlarged and distorted but does not open. Some buds are so heavily infested that they shrivel and die. If an infested bud is broken open, it will be noted that there is a considerable amount of fluid between the petals and that the larvae live in a very wet environment compared to the interior of a normal bud. There is one generation a year, with galling of the flower buds occurring during May to late July; varieties of *Hemerocallis* that flower late in the summer miss infestation. Control of this pest is proving difficult because of the concealed nature of the larvae and the limited opportunities to kill the adults before egg laying has occurred.

My next insect is the pyracantha leaf mining moth, *Phyllonorycter leucographella* (Zeller) (Lepidoptera: Gracillariidae). I do not intend to say a great deal about this because at the meeting of 14 April you will hear a detailed account of this moth and the survey that is being carried out to monitor its spread from David Agassiz. I claim the right to include it in my lecture because I found it first! A few leaves from the shrub firethorn (*Pyracantha coccinea*) were sent to me in early March 1989 from a private garden in Wickford, Essex. They had a very distinctive silvery white mine on the upper leaf surface, evenly spread either side of the midrib and occupying most of the leaf surface. There was a dead larva in one of the mines, which showed it to be the work of a leaf mining caterpillar, but there was no description of such mines in the Society's publication *A field guide to the smaller British Lepidoptera*. The specimens were therefore passed on to Maitland Emmet, who immediately recognized the mines as those of *P. leucographella*, a species new to Britain. In the following weeks Emmet and some friends spent their spare time peering over garden fences looking for infested pyracanthas in order to find out how widespread it was. By May 1989 it was known to be present in most of the south-eastern half of Essex (Emmet, 1989), and it has since spread further within this county and into east London and south Hertfordshire. During his survey Emmet noted that some plants had a very high proportion of the foliage affected by the leaf miner. It is surprising therefore that since receipt of the original samples no others have been referred to Wisley Garden, despite the leaf miner's obvious effects on pyracantha leaves and its widespread occurrence in Essex. *P. leucographella* originates from southern Europe but has spread into other countries, such as France, Germany, Austria, Holland and Switzerland.

I believe that during their term of office all Presidents of this Society should endeavour to add at least one insect to the British list. My contribution is the acacia sucker, *Acizzia* (*Pyslla*) *uncatoides* (Ferris & Klyver) (Hemiptera: Psyllidae), which I have been saving up since September 1990. Further details of this sap-feeding insect are given in a separate paper published elsewhere in this edition of the Journal (Halstead, 1992).

My final pest is western flower thrips, *Frankliniella occidentalis* (Pergande) (Thysanoptera: Thripidae). This sap-feeding insect originates from north America and it has all the attributes necessary to make it a successful invader of new countries. Like most thrips it is a small narrow-bodied insect and it has yellowish-brown adults little more than 2 mm long. The adults and nymphs often conceal themselves in partially opened flower and vegetative buds where they can feed undetected until

later when the damage becomes apparent (Plate I, Figure 2). It has a very wide range of host plants which includes tomato, cucumber, saintpaulia, gloxinia, achimenes, *Primula* spp., pelargonium, fuchsia, impatiens, streptocarpus, verbena and chrysanthemums. In Britain it is mainly a pest of plants in glasshouses and of house plants but it does attack outdoor plants and can survive mild winters in the open. Western flower thrips breeds very rapidly under suitable conditions. At a constant temperature of 15 °C the life cycle from egg to egg laying takes 44 days; at 20 °C this is reduced to 22.4 days and at 30 °C it is just 15 days. The highest reproductive rate was recorded at 20 °C with 95.5 hatched eggs / female (Lublinkhof & Foster, 1977). On many of its host plants western flower thrips is mainly associated with the flowers, where its feeding causes a loss of pigmentation from the petals and early decline of the blooms or complete failure of the buds to open. On other plants, such as cucumber and tomato, it also attacks the leaves, causing a silvery discoloration of the upper leaf surface. Western flower thrips is an efficient vector of tomato spotted wilt virus which has severe effects on the growth of many plants.

F. occidentalis arrived in Holland in 1984 (Cevat, 1987) and has since become widespread in Europe. It was first detected in Britain in June 1986 in commercial chrysanthemum nurseries, where it was suspected of having been introduced with imported cuttings. It was initially declared a 'notifiable pest' and a vigorous eradication programme was carried out at all premises where it was found. It soon became apparent that the thrips had become too widespread and it was taken off the notifiable list the following year. It is now present in the glasshouses of many commercial nurseries and is on sale in a garden centre near you!

Western flower thrips is far from easy to control. It has come to Europe with resistance or tolerance to some insecticides. Those chemicals which are effective may not be approved for use in glasshouses or may cause damage to tender parts of plants, such as flowers and shoot tips. Many commercial growers have in recent years gone over to using biological control for pests such as glasshouse whitefly and red spider mite because of the occurrence of pesticide resistance amongst these pests. Insecticides used against thrips are not selective and will be harmful to predators and parasitoids being used against other pests. Predatory mites, *Amblyseius* spp., are being used with some success against western flower thrips and the use of predatory bugs, *Orius* spp., is being investigated.

Until recently plant health inspectors have been able to examine imported plant material at the docks and airports. If the goods were found to have problems with pests or diseases the PHSI could order their destruction or require them to be returned to the country of origin. With the advent of 1992 and the establishment of a single market within the European Community countries it is no longer acceptable to have what might be construed as trade barriers at national borders. A new system of 'plant passports' has been devised whereby the health of plants intended for export will be checked in the producer's nursery. Once they have been given a clean bill of health, they can be transported anywhere within the EC without any further checks. Whether this new system will be an improvement remains to be seen—most people in the horticultural business have their fingers crossed that it will not be any worse.

Before I end my address I would like to acknowledge the help I have received over the years from fellow entomologists in establishments such as the Natural History Museum, the International Institute of Entomology and the Plant Health and Seeds Inspectorate. Their knowledge of taxonomy and the world's invertebrate fauna is of vital importance in preventing the successful establishment of new pests. If a new pest can be recognized quickly and correctly identified, there is a chance that it can be eradicated before it has become too widespread. Delays in obtaining an accurate

identification of a pest may result in its biology being misunderstood and inadequate or unsuitable control measures being applied. In recent years there have been cuts in funding for taxonomic work. This has led to a reduction in the support services for people involved in applied entomology which does not bode well for the future.

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LETTER TO THE EDITOR

Holotypes in private collections.—I was disturbed to note that in Peter Chandler's article on mycetophilids (*Br. J. Ent. Nat. Hist.* 1991; **4**: 143–155), there is no statement as to the whereabouts of the holotypes of some of the new species described. This leaves the impression that the holotypes are in the private collections of the individuals who collected the specimens. The International Code of Zoological Nomenclature proposes that holotypes should be deposited in national institutions, for very good